WILSHIRE
CONSULTING

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Managing Director

August 23, 2006

Mr. Russell Read
Chief Investment Officer
California Public Employees' Retirement System
400 P Street, Suite 3492
Sacramento, CA 95814

Re: Return / Risk Ratio Analysis

Dear Russell,

At the August 2006 Investment Committee meeting, a number of questions were raised regarding a variety of commonly used return/risk ratios. We believe that it would be useful to the Investment Committee to summarize the most common of these, and to discuss the definition, calculation, and usage of these terms with the Investment Committee at the September Investment Committee meeting. Attached is a brief description of each ratio along with how it is generally used in the investment industry.

We hope that this discussion lends some clarity to the Investment Committee members regarding the usage and calculation of these terms. If there are additional metrics that you believe would be of value to include, please do not hesitate to let me know.

Sincerely,

Michael C. Schlachter, CFA
Managing Director

Summary of Return/Risk Terms and Ratios

Term	Absolute/Relative	Usage
Information Ratio	Relative	Comparing managers'/composites' risk adjusted returns
Sharpe Ratio	Absolute	Measures the reward per unit of total risk taken
Treynor Ratio	Relative	Compares managers'/composites' returns adjusted for systematic risk (Beta)
Sortino Ratio	Absolute	Measures the reward per unit of historical losses
Value at Risk	Absolute	Calculates the potential dollar loss possible in a given time period
Performance at Risk	Relative	Calculates the potential deviation of returns from the benchmark in a given time period

Information Ratio

Definition: The Information Ratio is the most common measure of volatility-adjusted returns, and is used in measuring the performance of any portfolio or composite that is managed *relative* to a benchmark.

The Information Ratio expresses the amount of excess return that has been earned per unit of excess risk (tracking error) – essentially the amount of "bang for the buck" a portfolio earns per unit of relative risk allowed.

Calculation: Information Ratio = Excess Return / Tracking Error

Limitations: Used only for portfolios / composites relative to a benchmark. Not a useful measurement for assessing risk on an absolute basis.

Example: Over the last five years, Enhanced Money Manager ABC has returned 11.5% versus 10.5% for the benchmark. Tracking Error (standard deviation of excess returns) has been approximately 2.0% over that time period.

Information Ratio = 0.5 (1.0% excess return / 2.0% excess risk)

Desirable?: The higher the ratio, the better. A ratio of roughly 0.4 is generally considered to be excellent, although enhanced index managers and other risk-controlled portfolios can often have ratios above 1.0.

Sharpe Ratio

Definition: The Sharpe Ratio measures the risk-adjusted performance of an investment asset or a trading strategy, and is useful for calculating how well the investor is rewarded for *total* risk taken.

The Sharpe Ratio is not benchmark-relative, but compares all assets to the risk free rate and uses the absolute volatility of returns (not excess volatility as with the information ratio). As a result, the Sharpe Ratio is useful for comparing the risk-adjusted returns of different investments or asset classes.

Calculation: Sharpe Ratio = (Return – Risk Free Rate) / Standard Deviation of Returns

Limitations: Used for investments relative to the risk free rate, not to a benchmark. Therefore, the Sharpe Ratio is best for comparing asset classes, total fund returns, or absolute return portfolios, but not index-sensitive portfolios.

As the Risk Free Rate has climbed from 1.0% to more than 5.0% over the last 2 years, Sharpe Ratios have generally declined for portfolios without any change in investment strategy or approach. As rates decline in a downturn, Sharpe Ratios will rise.

Example: Over the last five years, Asset Class 1 has returned 8.0% with a standard deviation of returns of 14%. Asset Class 2 has returned 5.75% with a standard deviation of returns of 7%. The Risk Free Rate is 5.0%

Sharpe Ratio 1 = 0.21 (8.0% - 5.0%) / 14%
Sharpe Ratio 2 = 0.11 (5.75% - 5.0% / 7%

Desirable?: The higher the ratio, the better. However, in cases where a “hurdle” return is required, total return should also be considered. For example, in the case above, if a hurdle return of 7% were required, Asset Class 2’s Sharpe Ratio is less meaningful since the hurdle was not met.

Treynor Ratio

Definition: The Treynor Ratio is a measurement of the returns earned in excess of that which could have been earned on a riskless investment.

The Treynor Ratio relates excess return over the risk-free rate to the additional risk taken; however systematic risk (Beta) is used instead of total risk (standard deviation).

Useful for comparing the performance of portfolios with differing degrees of leverage.

Calculation: Treynor Ratio = (Portfolio Return – Risk Free Rate) / Beta

Limitations: Used for comparing different portfolios with a similar benchmark, since Beta is required in the calculation. Not useful for comparing portfolios in different asset classes.

Example: Over the last five years, Long/Short Manager 1 has returned 12% versus 8% for the benchmark, with a Beta of 2.0. Long/Short Manager 2 has returned 10%, with a Beta of 1.5.

Treynor Ratio 1 = 2.0 (12% - 8%) / 2.0
Treynor Ratio 2 = 1.33 (10% - 8%) / 1.5

Desirable?: The higher the ratio, the better.

Sortino Ratio

Definition: The Sortino Ratio is an extension of the Sharpe Ratio that only considers volatility in periods in which the portfolio is down. The Ratio yields a calculation that expresses the performance of the portfolio as a function of worst-case volatility – essentially how much down-side risk is the portfolio taking to earn the returns experienced?

Volatility of returns in up periods is not considered, since this ratio implies that investors do not consider earning excess returns to be a risk.

Most useful for absolute return investing.

Calculation: Sortino Ratio = (Portfolio Return – Risk Free Rate) / Standard Deviation of Negative Excess Returns

Limitations: Used for investments relative to the risk free rate, not to a benchmark. Therefore, the Sortino Ratio is best for comparing asset classes, total fund returns, or absolute return portfolios, but not index-sensitive portfolios.

Limiting calculation to downside volatility reduces the amount of information used in the ratio. An argument could be made that excessive upside volatility could be indicative of unwanted risks in a portfolio that would not be captured by the Sortino ratio. Extended periods of positive returns also limit the Sortino ratio's value as there are fewer observations of downside volatility in the ratio.

Example: Over the last five years, Absolute Return Manager 1 has returned 7.0% with a standard deviation of downside returns of 3%. Absolute Return Manager 2 has returned 6.0% with a standard deviation of downside returns of 1%. The Risk Free Rate is 5.0%

Sortino 1 = 0.67 (7.0% - 5.0%) / 3%
Sortino 2 = 1.00 (6.0% - 5.0% / 1%

Desirable?: The higher the ratio, the better. A portfolio with few to no down periods could theoretically have an infinite Sortino Ratio.

Value At Risk

Definition: Value at Risk ("VaR") is a measure of how much the market value of an asset or portfolio is likely to decrease in a given period (usually a short period measured in days) under a variety of conditions.

VaR can be calculated as both a potential loss under "normal" market conditions, or as a worst-case scenario in the event of market shocks.

VaR is a very useful concept for understanding the total impact to a portfolio with a variety of asset classes and investments, since some market environments may benefit some asset classes even though others decline in value.

Calculation: Is the result of a probability distribution. VaR is usually calculated via a comprehensive risk measurement system which can "stress-test" a portfolio against a variety of market conditions and shocks.

Limitations: The VaR calculation is only as good as the data fed into the model and the model itself. An unanticipated market shock may cause losses in excess of that calculated by a VaR model

Example: (These are hypothetical examples) Given its investments in a wide variety of asset classes, the $208BN CalPERS portfolio could be expected to gain or lose no more than $4BN in value on any given day, with a certainty of 90%.

In the event of a major oil disruption, CalPERS could be expected to lose up to $15BN in value over a five day period, with a certainty of 80%.

Desirable?: Generally, the lower the VaR, the better. However, unless an investor is willing to take a risk, returns usually will not be forthcoming. Therefore, VaR is usually a calculation that drives the asset allocation, not the other way around. If CalPERS is willing to gain or lose $2BN on a given day, the resulting asset allocation will be more conservative than if a VaR of $4BN is desired.

Performance At Risk

Definition: Performance at Risk ("PaR") is a measure of how much the performance of a portfolio of investments can differ from a benchmark's return under both normal and shock conditions.

A portfolio with a significant amount of passive investments would be expected to have a low PaR, regardless of the total (VaR) risk in the portfolio, since it will be expected to track the benchmark closely.

A portfolio with many active investments and hedges could have a lower VaR than a purely passive portfolio, but would have a higher PaR since performance would be unlikely to track the benchmark as closely as might an index fund.

Calculation: Is the result of a probability distribution. PaR is usually calculated via a comprehensive risk measurement system which can "stress-test" a portfolio against a variety of market conditions and shocks.

Limitations: The PaR calculation is only as good as the data fed into the model and the model itself. An unanticipated market shock may cause losses in excess of that calculated by a PaR model

Example: (Hypothetical examples) A diversified portfolio with 80% of its investments in passive vehicles could expect to have 25bp of PaR under normal circumstances, while a similarly diversified portfolio with 40% passive might have a PaR of 75bp.

Desirable?: Generally, the lower the PaR, the more closely the performance of the total portfolio will track the benchmark or composite.

PaR is usually a calculation that determines the investment structure within asset classes. The more a client is willing to allow returns to deviate from the benchmark for any given asset class, the more investments in active or enhanced portfolios that client will have.